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### REMARKS

An Excess Claim Fee Payment Letter is submitted herewith to cover the cost of two (2) excess total claims.

Claims 1-71 are all the claims presently pending in the application. Claims 1, 7, 25, 29, 33, 34, 36, 37, 41, 43, 52, 54 and 64-66 have been amended to more particularly define the invention. Claims 70-71 have been added to claim additional features of the invention.

It is noted that the claim amendments are made only for more particularly pointing out the invention, and not for distinguishing the invention over the prior art, narrowing the claims or for any statutory requirements of patentability. Further, Applicant specifically states that no amendment to any claim herein should be construed as a disclaimer of any interest in or right to an equivalent of any element or feature of the amended claim.

Claims 64-66 stand rejected because the claimed invention is directed to non-statutory subject matter (e.g., 35 U.S.C. § 101). Applicant notes that these claims have been amended in accordance with the Examiner's suggestion to address the Examiner's concerns. Thus, these claims are clearly statutory subject matter. Therefore, Applicant respectfully requests that the Examiner withdraw this rejection.

Claims 1-33, 35-48, 57-62 and 64-69 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Choi, et al. ("Deterministic Replay of Java Multithreaded Applications", August 1988), in view of W. Richard Stevens (*TCP/IP Illustrated, Volume 1, The Protocols*, 1994). Claims 34 and 49-56 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Choi, et al., in view of W. Richard Stevens and in further view of Patrick Chan (*The JAVA Developers Almanac, The JAVA Series from the Source*, 1998).

These rejections are respectfully traversed in the following discussion.

#### **I. THE CLAIMED INVENTION**

The claimed invention (e.g., as recited in claim 1) is directed to a method for recording and replaying execution of distributed programs on a computer system in a distributed environment. The method includes identifying an execution order of critical events of a program,

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generating groups of critical events of the program, wherein for each group, critical events belonging to the group belong to a common execution thread, and generating, for each execution thread, a logical thread schedule that identifies a sequence of the groups so as to allow deterministically replaying a non-deterministic arrival of stream socket connection requests, a non-deterministic number of bytes received during message reads, a non-deterministic binding of stream sockets to local ports, and a non-deterministic arrival of datagram messages.

Importantly, deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase (Application at page 31, line 17-page 32, line 17).

Conventional methods do not allow for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment (Application at page 6, lines 2-7).

In the claimed invention, on the other hand, deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase (Application at page 31, line 17-page 32, line 17). This identity may be logged in the record phase and reused in the replay phase, and allows identification of the sender of a message or connection request. Further, this feature allows the claimed invention to provide for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment (Application at page 6, lines 9-16).

## **II. THE ALLEGED PRIOR ART REFERENCES**

### **A. The Choi/Srinivasan Article and the Stevens Book**

The Examiner alleges that the Choi/Srinivasan Article and the Stevens Book would have been combined to form the claimed invention of claims 1-33, 35-48, 57-62 and 64-69. Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

The Choi/Srinivasan Article discloses a record/replay tool for Java applications, called DejaVu that provides a deterministic replay of a non-deterministic execution. DejaVu is

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independent of the underlying thread scheduler and runs on a uniprocessor system (Choi/Srinivasan Article at page 12, left column).

The Stevens book discloses two application programming interfaces (APIs) for applications using the TCP/IP protocols, sockets and transport layer interface (TPI) (Stevens at page 17).

However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, the Choi/Srinivasan Article is directed to a record/replay tool for Java applications, whereas Stevens is merely directed to a TCP/IP protocols. Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither the Choi/Srinivasan Article, nor the Stevens book, nor any combination thereof teaches or suggests a method for recording and replaying execution of distributed programs on a computer system in a distributed environment, "*wherein said deterministically replaying comprises recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase*", as recited in claim 1 and similarly recited in claims 60-61 and 64-69.

As noted above, unlike conventional methods do not allow for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment, the claimed invention includes a method for recording and replaying execution of distributed programs on a computer system in a distributed environment in which deterministically replaying

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includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase (Application at page 31, line 17-page 32, line 17). This identity may be logged in the record phase and reused in the replay phase, and allows identification of the sender of a message or connection request. Further, this feature allows the claimed invention to provide for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment (Application at page 6, lines 9-16).

Clearly, the cited references do not teach or suggest these novel features. Indeed, Applicant submits that, contrary to the Examiner's erroneous allegations, multiprocessor applications do not imply that they always have network I/O operations in them. Thus, the techniques to implement replay of network I/O cannot be easily deduced by anyone who is merely familiar with Steven's teachings.

With network operations, multiple JVM's are involved, which may require the identification of which JVM generated a network operation and capture of these network operations at each participating JVM in the replay mechanism. Nowhere is this notion taught or suggested by the cited references.

The claimed invention provides details of how network I/O (e.g., socket and datagram reads, writes, listen, bind, etc.,) in Java can be replayed. For example, the claimed invention may use unique VM-id's to keep track of the sender and receiver of the network events. The VM-id is not something that can be inferred easily from the cited references (e.g., the Choi/Srinivasan Article).

More specifically, clearly, these features are not taught or suggested by the Choi/Srinivasan Article. Indeed, the Choi/Srinivasan Article is completely unrelated to the claimed invention.

Further, the Examiner expressly concedes that the Choi/Srinivasan Article does not teach or suggest this feature. However, the Examiner alleges that "Choi did allow for the possibility of the DejaVu system to operate in a networked environment" (Office Action at page 9). Applicant respectfully submits, however, even assuming that the Choi/Srinivasan Article discloses a

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networked environment, the Examiner is making a giant leap from such a mere "idea" to actually setting forth a concept of how to implement a method for recording and replaying execution of distributed programs on a computer system in a distributed environment.

Clearly, the Examiner cannot reject Applicant's invention merely because a concept allegedly related to the invention may have been suggested previously. The Examiner must provide more (Indeed, using the Examiner's logic, a working "time machine" could never be patented it because the concept was suggested by H. G. Wells in the 19<sup>th</sup> century, a "phaser" could never be patented because the concept was suggested by Gene Roddenberry, and so on).

In fact, the Examiner must show at least that such a "concept" included a teaching or suggestion of how such a concept could be implemented (i.e., how to make and use the invention). Clearly, the Examiner has failed to make such a showing in this case. That is, nowhere does the Choi/Srinivasan Article teach or suggest the method of the claimed invention, in which deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase.

Similarly, the Stevens book does not teach or suggest this feature. Indeed, as noted above, the Stevens book merely discloses two application programming interfaces (APIs) for applications using the TCP/IP protocols, sockets and transport layer interface (TPI). Nowhere does the Stevens book teach or suggest a method in which deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase as in the exemplary aspects of the claimed invention.

Therefore, Applicant submits that these references would not have been combined, and even if combined the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

#### **B. The Chan Book**

The Examiner alleges that the Choi/Srinivasan Article and the Stevens Book would have been combined with the Chan book to form the claimed invention of claims 34 and 49-56.

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Applicant submits, however, that these references would not have been combined and even if combined, the combination would not teach or suggest each and every element of the claimed invention.

The Chan book discloses JAVA packages, classes and methods. However, Applicant submits that these references would not have been combined as alleged by the Examiner. Indeed, these references are directed to different problems and solutions.

Specifically, the Chan book merely describes JAVA packages, classes and methods, which is unrelated to the record/replay tool of the Choi/Srinivasan Article or the TCP/IP protocols of the Stevens book. Therefore, these references are completely unrelated, and no person of ordinary skill in the art would have considered combining these disparate references, absent impermissible hindsight.

Further, Applicant submits that the Examiner can point to no motivation or suggestion in the references to urge the combination as alleged by the Examiner. Indeed, contrary to the Examiner's allegations, neither of these references teach or suggest their combination. Therefore, Applicant respectfully submits that one of ordinary skill in the art would not have been so motivated to combine the references as alleged by the Examiner. Therefore, the Examiner has failed to make a prima facie case of obviousness.

Moreover, neither the Choi/Srinivasan Article, nor the Stevens book, nor the Chan book, nor any combination thereof teaches or suggests a method for recording and replaying execution of distributed programs on a computer system in a distributed environment, "*wherein said deterministically replaying comprises recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase*", as recited in claim 1 and similarly recited in claims 60-61 and 64-69.

As noted above, unlike conventional methods do not allow for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment, the claimed invention includes a method for recording and replaying execution of distributed programs on a computer system in a distributed environment in which deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned

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a unique virtual machine identity during a record phase (Application at page 31, line 17-page 32, line 17). This identity may be logged in the record phase and reused in the replay phase, and allows identification of the sender of a message or connection request. Further, this feature allows the claimed invention to provide for efficient recording and replaying execution of distributed programs on a computer system in a distributed environment (Application at page 6, lines 9-16).

Clearly, these features are not taught or suggested by the Chan book. Indeed, the Chan book is completely unrelated to the claimed invention.

As noted above, the Chan book merely discloses JAVA packages, classes and methods. Nowhere does Chan teach or suggest a method for recording and replaying execution of distributed programs on a computer system in a distributed environment, let alone such a method in which deterministically replaying includes recording events of a plurality of virtual machines, each virtual machine being assigned a unique virtual machine identity during a record phase.

Moreover, as noted above, Applicant submits that multiprocessor applications do not imply that they always have network I/O operations in them. Thus, it cannot be easily deduced, by anyone familiar with Chan's teachings, the techniques to implement replay of network I/O.

Further, the teachings of Stevens and Chan cannot be used in combination with the Choi/Srinivasan Article to deduce the claimed invention (e.g., a VM-id idea) in a straightforward manner. Likewise, other specific network I/O replay features (e.g., in claims 37-69) cannot be deduced by the cited references. Therefore, Chan clearly does not make up for the deficiencies of the Choi/Srinivasan Article and the Stevens book.

Therefore, Applicant submits that these references would not have been combined, and even if combined the combination would not teach or suggest each and every element of the claimed invention. Therefore, the Examiner is respectfully requested to withdraw this rejection.

### III. FORMAL MATTERS AND CONCLUSION

Applicant notes that claim 41 has been amended to address the Examiner's objection thereto.

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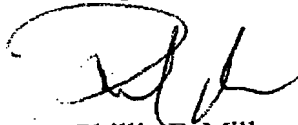
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In view of the foregoing, Applicant submits that claims 1-71, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Assignee's Deposit Account No. 50-0510.

Respectfully Submitted,



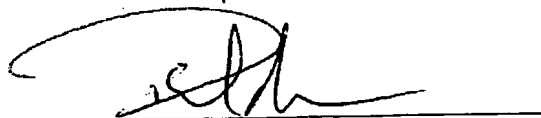
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**CERTIFICATE OF FACSIMILE TRANSMISSION**

I hereby certify that the foregoing Amendment was filed by facsimile with the United States Patent and Trademark Office, Examiner Mary Steelman, Group Art Unit # 2122 at fax number (703) 872-9306 this 28th day of May, 2004.



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